PUBLIC POLICY PRINCIPLES FOR PROMOTING EFFICIENT WIRELESS INNOVATION AND INVESTMENT

Michael L. Katz

September 30, 2009

CONTENTS

I. INTRODUCTION AND OVERVIEW

1. The Federal Communications Commission (Commission) has opened a proceeding in which the Commission seeks "to understand better the factors that encourage innovation and investment in wireless and to identify concrete steps the Commission can take to support and encourage further innovation and investment in this area."[1]

2. I have been asked by counsel for AT&T to conduct an economic analysis of the effects of public policies on wireless innovation and investment. I conclude that public policies should encourage innovation and investment in all parts of the wireless ecosystem, including core networks, access devices, and applications. To achieve the Commission's stated goal, it is essential that public policies do not become an "innovation tax" or penalty for successful investment. Public policies also should not unduly restrict suppliers' choices of business models and organizational structure (including the use of vertical contracting agreements) in the wireless marketplace. By far the most likely effects of public policies that impose sweeping restrictions on these choices will be to reduce innovation and investment, to consumers' detriment. Innovation and investment are best promoted by public policies that protect competition, and innovation and investment are harmed by public policies that distort competition in order to protect suppliers that fail to invest, innovate, or develop successful business models. An important way in which Commission policies can promote wireless competition, innovation, and investment is by licensing increased amounts of spectrum.

---

[1] Federal Communications Commission, Notice of Inquiry, *Fostering Innovation and Investment in the Wireless Communications Market; A National Broadband Plan For Our Future*, FCC 09-66, GN Docket Nos. 09-157, 09-66 (rel. August 27, 2009) (hereinafter, *NOI*) at 1.

3. Briefly, my specific findings are the following:

- *Consumers are best served when public policy promotes efficient innovation and investment in all parts of the wireless ecosystem.* Innovation is widely recognized as the engine of overall economic growth, and it is critical to the development and distribution of ever-improving wireless services, equipment, and applications to consumers. Investment is also critical. Indeed, without investment there would be little or no innovation. Innovation results from investment in research and development (R&D) activities, and investment in facilities, equipment, and marketing activities is necessary to bring the results of innovation to wireless consumers. Consumers enjoy the full potential benefits of innovation if and only if innovation and investment occur in all parts of the ecosystem, including the core networks. To date, that innovation and investment has been occurring.

- *Because private enterprises are by far the most important sources of innovation and investment in wireless, it is essential that public policy take into account the drivers of private investment and innovation.* Private enterprises undertake costly investments—including investments in R&D activities that lead to innovation—if and only if they expect to earn a sufficient economic return on those investments. Many investments in wireless involve large sunk costs and highly uncertain returns. It is vital that public policy makers take this risk into account and not draw mistaken conclusions from the apparently high rates of return earned by successful investment projects.

- *Innovation taxes or success penalties, such as various forms of mandatory asset sharing or limits on successful enterprises, undermine innovation and investment*

incentives. Policies such as mandatory data roaming or spectrum caps reduce innovation and investment incentives by reducing the expected returns to innovation and investment. This effect arises because an enterprise that is forced to share the fruits of its successful investment projects no longer gains as much—or indeed, in some cases, any—competitive advantage from those projects.[2]

- *Wireless services are provided by competing systems of components.* Consumers derive benefits from wireless services by making use of several components that work together in an integrated system. Competition can—and does—occur at both the component and system level.

- *Absent clear and specific evidence of competitive harms, public policy should not unduly limit coordination among suppliers of complementary system components.* The individual components of a wireless system each have little value in isolation, but they can be very valuable in combination as long as they work well together. Hence, the consumer benefits of wireless are greatest when there is coordinated investment and innovation by infrastructure manufacturers, wireless carriers, handset manufacturers, operating system developers, and application providers. Public policies should not unnecessarily restrict coordination. Yet that is exactly what some

---

[2] In addition, the enterprises that take advantage of the mandatory sharing no longer have to make substitute investments of their own—they can simply free ride on other investors and innovators. A central rationale for mandatory sharing is that it may stimulate complementary investments by firms taking advantage of the policy. However, as I have discussed elsewhere, such policies appear to have failed in several very important instances. (Declaration of Michael L. Katz, "Investment, Innovation, and Competition in the Provision of Broadband Infrastructure," Comments of Verizon and Verizon Wireless, *In the Matter of A National Broadband Plan for our Future*, GN Docket No. 09-51, June 8, 2009 (hereinafter, *Katz Broadband Declaration*) at 15.)

proposals, such as bans on exclusive dealing arrangements between carriers and handset manufacturers, would do.

- *Competitive market forces create incentives for investment and innovation that satisfy consumer needs and desires.* In a competitive marketplace, those companies that are most successful at satisfying consumers' needs and desires will earn the greatest financial returns. Conversely, companies that invest in, and bring to market, innovations that are not desired by consumers will fail to be commercially successful. Thus, competition drives firms to act to the benefit of consumers.

- *The Commission should protect competition, not distort it.* The primary means by which the Commission can achieve its stated goal of promoting wireless innovation and investment is thus to promote and protect the competitive process, so that consumer preferences determine winners and losers in the marketplace.

4. The remainder of this white paper explains these findings in greater depth and provides details of the facts and analysis that led me to reach them.

II. INVESTMENT AND INNOVATION ARE VITAL TO CONSUMER WELFARE

5. Absent the significant past investment in wireless networks, handsets, and applications, consumers would not enjoy today the tremendous benefits that wireless services generate. And absent continued investments in infrastructure and innovation, consumers will not see the continued rapid growth of those benefits. Indeed, there is a broad consensus

among economists that innovation and technological change are critical components of a healthy economy and drivers of increasing wealth.[3]

A. INNOVATION AND INVESTMENT PROMOTE CONSUMER WELFARE WHEN THEY RESULT IN PRODUCTS AND SERVICES THAT CONSUMERS VALUE

6. United States telecommunications policy has a fundamental goal of promoting consumer welfare. Investment and innovation are not valued in and of themselves; rather they are valued for the consumer benefits that they generate. Thus, it is vital that public policies create an economic environment in which firms have incentives to engage in investment and innovation that satisfy consumer demands. Given the complexity and variety of consumer demands, this is best done by promoting undistorted competition. Public policies that attempt to dictate the course of market evolution are unlikely to serve consumer interests.

7. Wireless services have multi-dimensional characteristics about which consumers care. For example, consumers value various measures of service quality (including clarity of voice communications, speed of data transmissions, reliability of connections, and breadth of coverage), price, ease of use, security, and access to applications. Together, these multi-dimensional characteristics shape a consumer's overall wireless experience.

8. Market experience demonstrates that consumers differ widely in the importance that they attach to different characteristics of their wireless experience. Some customers prefer a wireless service that provides them access to a virtually unlimited range of web-based applications through the Internet. Other customers instead prefer a more integrated and

---

[3] See, for example, Michael L. Katz and Howard A. Shelanski (2007), "Mergers and Innovation," *Antitrust Law Journal* **74**(1): 1-86; Robert M. Solow (1956), "A Contribution to the Theory of Economic Growth," *Quarterly Journal of Economics* **70**(1): 65–94.

circumscribed experience that provides greater ease of use, security and protection of service quality and emphasis on particular functionalities that are particularly valuable to the end user (*e.g.*, music, texting, email, and photographic capabilities). Some customers prefer to make use of bandwidth intensive applications such as streaming media, while other customers prefer to use their wireless service for voice and text-based emails only.

9. Well-informed consumers are the best judges of their own preferences. Given the diversity of consumer preferences in the wireless user population, consumer welfare is maximized when consumers are free to choose from among a range of different types of user experience. Of course, it is not efficient to offer every conceivable type of user experience—at some point, the cost of additional variety outweighs the benefit.

10. The fundamental point is that consumers benefit when there are several different products available that are aimed at meeting consumer needs because it is then likely that an individual consumer can find a product or service that closely matches her preferences. As will be discussed below, wireless consumers currently have a wide range of choices among competing service plans, handsets, and applications. Public policy serves consumer interests when it protects the competition that has given rise to this diverse set of offerings.

11. Public policy is very unlikely to serve consumer interests when it substitutes regulatory mandates for wireless providers' business judgments regarding which products to offer consumers and what business models to pursue, including the degree of network management or openness. The wireless industry today offers consumers a wide range of experiences, with alternatives that offer varying degrees of openness with regard to the hardware and software that are available as different firms have pursued different business

models. The wide array of choices available benefits consumers, both by offering a range of options today and by allowing for the testing of alternative approaches to see which will be the most successful in meeting consumer demands in the future. Regulatory policy that mandates a specific model of openness would, in critical respects, reduce consumers' choices, both today and in the future.

B. THERE HAS BEEN TREMENDOUS INNOVATION AND INVESTMENT IN WIRELESS SERVICES

12. Innovation and investment are critical to the continued evolution of wireless services. Without innovation and investment, new products and services will not come to market. Historically, there has been important innovation and investment within all layers of the wireless ecosystem, including network equipment, network management, handsets, handset operating systems (OSs), and applications. This innovation and investment has come from a wide range of players. Going forward, there is every reason to expect that innovation and investment in all of the components of wireless systems will continue to be important drivers of consumer welfare—absent public policies that stifle that innovation and investment. As the Commission has recognized, continued innovation and investment in the core network layer is particularly vital.[4]

1. The Current Industry Structure has Supported Rapid and Significant Innovation at the Edge

13. The wireless industry is characterized by rapid and pervasive technological progress in all layers. The most visible innovations are those at the "edge:" devices, operating systems, and applications. And some of the most visible edge innovations have been those embodied

---

[4] *NOI*, ¶ 48.

in the iPhone, which Apple introduced in June 2007. The iPhone had several innovative features including an improved touch screen interface, a full Internet browser, visual voicemail, and an accelerometer and other sensors that let the phone react to its environment.[5] The introduction of the iPhone spurred a competitive response from other device manufacturers. Table 1 illustrates the variety of smart phones that have been introduced in the past few years. At least six firms in addition to Apple now offer smart phones, and they offer an enormous variety of features to choose from. Furthermore, these firms continue to introduce new features. For example, the latest iPhone offers improved speed, a built-in video camera, voice control, spotlight search, and improved messaging.[6]

14. In addition, manufacturers are now offering netbooks that offer connectivity to both Wi-Fi networks and 3G mobile networks. Netbooks offer consumers a small, portable computer that functions entirely online.[7] With more and more computing functions available online and requiring little of the processing power of a laptop computer, netbooks are a simpler, cheaper alternative to full-size laptops that provide the core functions that consumers most frequently use.

---

5 Apple, Press Release, Apple Reinvents the Phone with iPhone (January 9, 2007), *available at* http://www.apple.com/pr/library/2007/01/09iphone.html, *site visited* September 28, 2009.

6 Apple, iPhone website, *available at* http://www.apple.com/iphone/, *site visited* September 28, 2009.

7 Clive Thompson, "The Netbook Effect: How Cheap Little Laptops Hit the Big Time," Wired Magazine (February 23, 2009), *available at* http://www.wired.com/gadgets/wireless/magazine/17-03/mf_netbooks?currentPage=all, *site visited* September 28, 2009.

Table 1: Smartphones

Company	Smartphones Offered	Features	Application Store
Apple	iPhone (3G, 3GS)	video camera, voice-activated calling and music playing, compass and map features, many others	Y
RIM	BlackBerry (Curve, Tour, Storm, Bold, Pearl, 8800 series)	certain models feature: touch screen, GPS, global capabilities, BlackBerry Maps, BlackBerry Media Sync, BlackBerry Wallet, many others	Y
Nokia	N97, E63, E75, 5800, N86, many others	certain models feature: touch screen, video camera, streaming video, MMS, picture sharing, Nokia Maps, many others	Y
Palm	Pixi, Pre, Treo Pro	certain models feature: linked contacts, automatic data backup, layered calendars, combined messaging, many others	Y
Motorola	CLIQ, QA1, A455, i465, QA4, QA30, and others	certain models feature: synched social networking sites, customized home screen, unique Motorola widgets, many others	N
HTC	HTC Hero, HTC Touch Cruise, HTC Touch Diamond, HTC Ozone, HTC S743, many others	certain models feature: touch screen, instant access to internet services, video messaging, choice of mobile operating systems	Y
Samsung	Solstice, Impression, Propel Pro, Eternity, Epix, many others	certain models feature: Windows Mobile or Android, Turbo Scroll, touch screens, multi-media capabilities, video camera	Y

Notes: HTC's application store is for its HTC Hero device, which supports Google's Android Market applications.
Table may not include all smart phones currently available.

Sources: http://www.apple.com/iphone/
http://na.blackberry.com/eng/devices/
http://www.nokiausa.com/find-products
http://www.palm.com/us/products/phones/
http://www.motorola.com/consumers/v/index.jsp?vgnextoid=7d75599075f5a110VgnVCM1000008406b00aRCRD
http://www.samsung.com/us/consumer/mobile/mobile-phones/index.idx?pagetype=type,
http://www.htc.com/us/product.aspx
http://blogs.zdnet.com/gadgetreviews/?p=7667

15. The most advanced devices are essentially miniature computers and require sophisticated operating system software to serve as an interface between application software and the hardware, as well as to provide a user interface. In recent years, consumers have benefited from substantial innovation in mobile operating systems. Table 2 shows the wide variety of mobile operating systems now available for wireless handsets. These operating systems represent a mix of business models, with some based on open standards and others based on proprietary, closed standards. Consumers have demonstrated interest in both business models. For example, the popular iPhone and Blackberry devices are based on the closed iPhone OS and Blackberry OS, respectively. In contrast, several firms—including HTC, LG, Motorola, Samsung, and Sony Ericsson—are introducing handsets that run the Android OS, which is licensed by Google and based on open-source Linux code.[8]

[8] Androphones website, *available at* http://www.androphones.com/, *site visited* September 23, 2009.

Table 2: Mobile Operating Systems

Wireless Handset OS	Company	Key Features	Proprietary/Open Source
Symbian	Symbian Foundation	compatibility with Office; OS is tailored to individual phones; ease of use; personal information management features	Began transition to open-source in mid-2009; fully open source by Fall 2009
iPhone	Apple	app recommendations; genius mixes; wireless ringtone downloads; many others	Proprietary
BlackBerry	RIM	streamlined interface; easy email attachment downloads; SureType; mobile streaming; BlackBerry maps; voice notes; many others	Proprietary
Maemo	Nokia	based on Linux; Firefox browser; personalized home screen; all content on phone accessible through phone's dashboard	Open Source
Windows Mobile	Microsoft	MyPhone (syncs texts, photos, video, contacts to web); Windows Marketplace for Mobile	Proprietary
webOS	Palm	interface performs many tasks instead of applications	Proprietary with open components
Android	Google	easy replacement of components; integrated browser; SQLite data storage; debugging tools; many others	Open source

Sources: http://www.theregister.co.uk/2009/07/10/symbian_security/
http://reviews.cnet.com/4520-11309_7-6624304-5.html
http://www.apple.com/iphone/softwareupdate/
http://news.yahoo.com/s/nf/20090827/bs_nf/68647
http://www.microsoft.com/presspass/press/2009/feb09/02-16MWCPR.mspx
http://arstechnica.com/gadgets/news/2009/01/palm-launches-new-handset-pre-operating-system-at-ces.ars

16. As handsets have become more powerful and the mobile operating systems have become more sophisticated, consumers have also gained access to thousands of innovative applications ranging from GPS and mapping software, to games and social networking. Apple started the trend by adding iPhone applications to its iTunes Store in 2008. In its first

eighteen months of operation, the online store experienced two billion downloads.[9] As Table 3 illustrates, other device manufacturers now offer similar application stores, although Apple's is still by far the largest. These application stores generally offer applications that have been developed by a broad range of entities, including private individuals, software companies, and wireless carriers. These applications range from frivolous to potentially life-saving. For example, AT&T is testing an application that would allow a doctor remotely to monitor the tread pattern of an elderly person and to intervene to prevent falls before they happen.[10]

---

9 Apple, Inc., Press Release, "Apple's App Store Downloads Top Two Billion," (September 28, 2009), *available at* http://www.apple.com/pr/library/2009/09/28appstore.html, *site visited* September 28, 2009.

10 Damien Joseph, "Could AT&T Prevent Falls Among the Elderly?" *BusinessWeek* (May 14, 2009), *available at* http://www.businessweek.com/innovate/next/archives/2009/05/how_att_could_p.html, *site visited* September 28, 2009.

Table 3: Mobile Application Stores

Company	Store	No. of Applications
Apple	App Store	85,000
Sony	PlayNow Arena	47,000+
Google	Android Market	10,000+
Nokia	Ovi Store	4,500
RIM	BlackBerry App World	2,000
Samsung	Samsung Application Store (not yet available in USA)	2,000
LG	Application Store (not yet available in USA)	1,400
Windows	Windows Marketplace for Mobile	600
Palm	App Catalog	30

Notes: Table reflects application stores of smartphone and operating system manufacturers. Additional application stores exist from mobile carriers and independent stores. Apple application count as of 9/28/2009; RIM count as of 9/10/2009; Samsung count is forecasted by end of 2009; Samsung Application Store launched in Europe on 9/14/2009; Windows count based on forecast of store opening in Fall 2009; Nokia count as of 9/14/2009; Google count as of 9/17/2009; Palm count as of 6/19/2009; Sony count as of 7/1/2009; LG count as of 7/13/2009.

Sources: http://www.apple.com/pr/library/2009/09/28appstore.html
http://www.eweek.com/c/a/Mobile-and-Wireless/Samsungs-New-App-Store-Looks-to-Compete-Against-Windows-Mobile-Apple-App-Store-782741/
http://www.electronista.com/articles/09/09/10/iphone.users.download.more.apps/
http://www.bangkokpost.com/business/telecom/23833/new-ovi-store-to-be-part-of-nokia-major-makeover
http://www.washingtonpost.com/wp-dyn/content/article/2009/09/08/AR2009090802799.html
http://www.wired.com/gadgetlab/2009/06/palm-pre-apps/
http://www.sonyinsider.com/2009/06/04/sonys-european-playnow-arena-set-to-eventually-take-on-apples-app-store-worldwide/
http://www.gsmarena.com/lg_application_store_launched_1400_titles_already_available-news-1015.php

2. The Current Industry Structure has Supported Significant Innovation and Investment in the Core

17. In recent years, the demands placed on the core wireless networks have increased exponentially. For example, there has been a nearly fifty-fold increase in data traffic on

AT&T's 3G wireless network in the last three years.[11] Because of the demands that the new applications are placing on the core network, many of the advances in edge applications would be impossible without corresponding investments in network infrastructure and technological advances in the spectral efficiency (*i.e.*, the number of bits that can be communicated over a given amount of bandwidth) of core networks.[12]

18. A brief history of the different generations of wireless networks illustrates these points. The first generation of cellular wireless communication ("1G") was introduced in the 1980s and based on analog telecommunications standards. The 1G technology was characterized by relatively low bandwidth and high power consumption, and it was generally suitable only for voice communications.[13] The second generation of cellular wireless communication ("2G") was introduced in the early 1990s and was based on digital telecommunications standards. The 2G networks had several advantages over analog communications. For example, digital data can be compressed much more effectively than analog data, which led to greater spectral efficiency and capacity. Additionally, digital

---

[11] Kris Rinne, SVP Architecture and Planning for AT&T, Tuesday Keynote, 4G World, September 15, 2009 at 5; see also Kevin Fitchard, "4G World: AT&T says HSPA+ is off the table for now," *TelephonyOnline*, September 15, 2009, *available at* http://telephonyonline.com/3g4g/news/Rinne-4gworld-keynote-091509, *site visited* September 28, 2009 ("data traffic on [AT&T's] 3G network has grown by almost 5000% in the last three years").

[12] AT&T, Press Release, "AT&T to Deliver 3G Mobile Broadband Speed Boost," (May 27, 2009), *available at* http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=26835, *site visited* September 28. 2009; see also AT&T, Press Release, "AT&T Launches Dedicated Certification Lab for Emerging Devices, Reinforces 'Open Innovation' Leadership," (September 2, 2009) *available at* http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=27080, *site visited* September 28. 2009.

[13] Jawad Ibrahim (2002), "4G Features," *Bechtel Telecommunications Technical Journal* (1)1: 11-14.

systems require less power, which led to smaller and longer-lasting batteries. 2G also allowed the provision of wireless data services, such as text messaging and email.[14] However, 2G networks offered relatively limited bandwidth. For example, when introduced, the GSM standard offered download rates only up to 14.4 kbps.[15]

19. Third generation ("3G") networks were designed to increase spectral efficiency further and to enable faster download speeds and a greater array of mobile applications. The most common 3G standards in the United States (CDMA EV-DO and WCDMA/HSDPA) offer typical download speeds of 400-800 kbps, and download speeds can be as high as 1.4 Mbps.[16]

20. By the end of 2006, 21.9 million mobile devices capable of accessing the Internet at broadband speeds were in use in the United States and more than 90 percent of the U.S. population lived in areas where they could access at least one 3G network.[17] U.S. carriers continue to upgrade the speed, capacity, and reach of their 3G networks. For example, AT&T is upgrading to High Speed Packet Access (HSPA) technology that allows for theoretical peak speeds of 7.2 Mbps.[18] Similarly, Verizon continues to deploy 3G EV-DO technology

---

14 *Id*.

15 *Id*.

16 Federal Communications Commission, Thirteenth Report, *In the Matter of Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services*, WT Docket No. 08-27 (rel. January 15, 2009) (hereinafter, *CMRS Competition Report, 2009*) at 9.

17 *CMRS Competition Report, 2009* at 9.

18 AT&T, Press Release, "AT&T to Deliver 3G Mobile Broadband Speed Boost," (May 27, 2009), *available at* http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=26835, *site visited* September 28, 2009.

throughout its wireless network.[19] Many other carriers, including U.S. Cellular,[20] Cox,[21] Cincinnati Bell,[22] Cellular South,[23] and Stelera Wireless[24] are also expanding their 3G networks.

21. The roll-out of faster core networks has improved the capability of devices in the market. For example, the Commission has noted that Apple's 3G iPhone runs on AT&T's WCDMA/HSDPA network, which "allows it to navigate the Internet at much faster speeds than the original iPhone launched in June 2007."[25]

22. Wireless carriers collectively invest billions of dollars each year to improve and innovate their networks. U.S. wireless carriers reported incremental capital expenditures on

---

19 Verizon Communications, Inc., Fiscal Year 2008 10-K, *available at* http://investor.verizon.com/sec/sec_frame.aspx?FilingID=6435582, *site visited* September 28, 2009 at 4.

20 U.S. Cellular, Press Release, "U.S. Cellular Reports Second Quarter Results," August 6, 2009, *available at* http://finance.yahoo.com/news/US-Cellular-Reports-Second-prnews-28050537.html?x=0&.v=1, *site visited* September 28, 2009; U.S. Cellular, "Expanding Wireless Broadband Wireless Services and Increasing Wireless Competition," September 8, 2009, attached to Letter from W. Lavey, Counsel of USCC, to M. Dortch, FCC, Docket Nos. 09-51, *et al.*, filed September 9, 2009.

21 Cox Communications, Press Release, "Cox To Launch Next Generation Bundle with Wireless in 2009," October 27, 2008, *available at* http://www.reuters.com/article/pressRelease/idUS88346+27-Oct-2008+PRN20081027, *site visited* September 28, 2009.

22 Cincinnati Bell Inc., 2008 Form 10-K, at 5 (SEC filed Feb. 27, 2009), *available at* http://library.corporate-ir.net/library/11/111/111332/items/329432/AF3CDD98-6630-42A9-B8F1-5C2A866655E2_2008AR.pdf, *site visited* September 28, 2009.

23 Cellular South, Press Release, "Cellular South Expands 3G High-Speed Mobile Broadband Data Services Throughout Much of Mississippi Delta Region," August 4, 2009, *available at* http://www.cellularsouth.com/news/2009/20090804.html, *site visited* September 28, 2009.

24 Stelera Wireless. Press Release, "Stelera Wireless Launches Wireless Broadband Network; Cutting Edge Internet Services Launched in South Texas," March 23, 2009, *available at* http://dev.stelerawireless.com/AboutUs/News/PressRoom/tabid/72/Default.aspx, *site visited* September 28, 2009.

25 *CMRS Competition Report, 2009* at 9.

their networks of $20.17 billion in 2008.[26] Much of this investment was spent to upgrade networks to 3G standards. For example, in 2008, AT&T's capital expenditures on wireless were "primarily for network capacity expansion, integration and upgrades to our Universal Mobile Telecommunications System/High-Speed Packet Access network."[27]

23. It should also be recognized that the innovation and investment in core networks necessary to support edge innovation is not limited to increased capacity. For example, as discussed in Section IV.C below, AT&T had to make several investments in its network hardware and software to support the introduction of the Apple iPhone.

C. FUTURE INNOVATION, BOTH AT THE EDGE AND IN THE CORE, IS DEPENDENT ON CONTINUED INVESTMENT IN THE CORE NETWORK

24. As discussed above, there has been tremendous innovation and investment both at the edge and in the core of wireless networks. The parallel paths are not a coincidence. Wireless services are an example of a systems service or product—consumer benefits are generated when several different components (*e.g.*, network equipment, handsets, and applications) are used together. Each of these components interacts with, and depends upon, other components in the system. For example, applications that make intensive use of bandwidth, such as streaming video, require networks that are capable of providing the bandwidth, operating systems that are capable of processing the data, and hardware that is capable of displaying the output. Thus, technological progress in the wireless system depends on advances and

---

[26] "Comments of CTIA-The Wireless Association," *In the Matter of Annual Report and Analysis of Competitive Market Conditions with respect to Commercial Mobile Wireless Services*, WT Docket No. 09-66, June 15, 2009 (hereinafter, *CTIA Comments*) at 13.

[27] AT&T, Annual Report 2008, *available at* http://www.att.com/Common/about_us/annual_report/pdfs/2008ATT_FullReport.pdf, *site visited* September 28, 2009, at 41.

innovations in all parts of the industry, and investment and innovation in the core network are essential to promoting edge innovation in applications and devices.

25. Even as they introduce and improve their 3G networks, U.S. carriers are simultaneously developing 4G networks that promise much higher data transmission speeds.[28] 4G technology will be entirely packet-based and promises several technological advances including: (1) increased spectral efficiency; (2) higher network capacity; and (3) peak data rates of 100Mbps or more.[29] The 4G standards are designed specifically to accommodate high-bandwidth applications such as multimedia messaging service, video chat, mobile TV and digital video broadcasting. Table 4 summarizes the introduction of 4G networks in the United States.

Table 4: U.S. Wireless Carriers' 4G Plans

Carrier	3G	4G	4G Schedule
AT&T	UMTS	LTE	Trials in 2010, commercial deployments in 2011
CenturyTel	--	LTE	Target initial commercial deployments in 2010
Cox	CDMA	LTE	TBD; currently building a CDMA EV-DO network upgradable to LTE
MetroPCS	CDMA	LTE	Target commercial deployments in 2010 (2H)
Sprint/Clearwire	N/A	WiMax	Construction acceleration in 2009 and 2010, with much of the build-out in 2010
T-Mobile	UMTS	LTE	TBD; has shown field trials, but has yet to announce rollout plans
Verizon	CDMA	LTE	Trials in 2009 commercial deployments in 2010

Sources: Goldman Sachs, "Mobile Broadband Update: 4G Wireless Ecosystems Taking Shape," May 26, 2009, at 9 http://news.cnet.com/8301-10784_3-9938068-7.html

---

28 The term “Long Term Evolution” (LTE) is often used synonymously with 4G.

29 MobileInfo, “4G-Beyond 2.5G and 3G Wireless Networks,” *available at* http://www.mobileinfo.com/3G/4GVision&Technologies.htm, *site visited* September 25, 2009.

26. Building 4G networks—and augmenting 3G networks in the interim—is projected to require tens of billions of dollars of private capital.[30, 31] Without that private investment, wireless innovation will necessarily slow and innovative new services and functionalities may be delayed or foreclosed.

27. Lastly, there is no reason to believe that 4G will be the final generation. Indeed, AT&T, MIT, Intel, and others are conducting basic research that could eventually lead to a 5G standard using TeraHertz waves.[32] The spectrum's short wavelengths make it well-suited for small, very-high-throughput systems, and there are potentially huge amounts of bandwidth available.[33] Significant innovation and investment in core wireless networks can be expected for many years to come.

D. POLICY PRINCIPLE: CONSUMERS ARE BEST SERVED WHEN PUBLIC POLICY PROMOTES EFFICIENT INNOVATION AND INVESTMENT IN ALL PARTS OF THE WIRELESS ECOSYSTEM

28. This discussion of wireless innovation and investment has a simple message for public policy making. Consumers will enjoy the full potential benefits of wireless services if and

---

30 Morgan Stanley, "Telecom Services 1Q Trend Tracker," June 5, 2009, at 87; Morgan Stanley, "Telecom Services 2Q Trend Tracker," August 31, 2009, at 87.

31 Of course, device and software developers are also investing significant amounts in developing new products. For example, Research in Motion, the manufacturer of Blackberry smart phones, spent close to $700 million on R&D in 2008. (Research In Motion, Press Release, "Research in Motion Reports Fourth Quarter and Year-End Results for Fiscal 2009," April 2, 2009, *available at* http://press.rim.com/release.jsp?id=2248, *site visited* September 28, 2009.)

32 IEEE 802.15 WPAN Terahertz Interest Group, *available at* http://www.ieee802.org/15/pub/IGthz.html, *site visited* September 25, 2009.

33 The THz frequency contains 2700 GHz of bandwidth, though current semiconductor technology allows access only to the low end of the band. See: IEEE 802.15 WPAN Terahertz Interest Group, *available at* http://www.ieee802.org/15/pub/IGthz.html, *site visited* September 25, 2009.

only if innovation and investment occur in all parts of the ecosystem, including the core networks. To date, the overall wireless innovation ecosystem has been very healthy, and available evidence points to continued innovation and investment by the wireless sector. The Commission should be very careful not to adopt policies that would disrupt this success. Specifically, the Commission should not try to pick winners or losers, or favor one layer of the wireless ecosystem over another. By its very nature, innovation is unpredictable. It is impossible to know what the breakthrough innovations will be or where they will come from. History confirms that important innovations occur within and across all layers and contours of the wireless ecosystem. Consumer welfare is therefore promoted by policies that do not rely upon governmental predictions about the most likely source of innovation or the business models that are most likely to succeed in the marketplace.

III. PUBLIC POLICIES THAT HARM PRIVATE FINANCIAL RETURNS WILL WEAKEN INNOVATION AND INVESTMENT INCENTIVES

29. There is widespread agreement that the vast majority of investment in innovation and facilities in the U.S. wireless sector will be made by private parties. Hence, public policy can successfully promote innovation and investment only if it creates an economic environment conducive to private investment.

A. FINANCIAL DRIVERS OF INNOVATION AND INVESTMENT

30. Private firms are motivated to make investments—including investments in R&D—by the prospect of profits generated by those investments. The decision to invest depends on level of initial investment required and the distribution of returns. All else equal, the greater the expected financial return from a given level of investment, the greater are the incentives to

undertake that investment. Conversely, public policies that reduce the financial returns to investment weaken private investment incentives.

31. An important fact is that the returns to most significant investments in the wireless sector are uncertain, in many cases to a very high degree. This uncertainty makes it essential to adjust the cost of capital to account for the degree of risk associated with an investment when calculating the economic profits associated with it. In practice, proper adjustment for risk can be very difficult. A failure to account properly for investment risk will yield inaccurate estimates of economic profits and misleading conclusions about competitive conditions in the wireless sector.

32. There is a closely related problem that arises because regulators observe realized project returns, not the expected returns at the time the service provider made its investment decisions. The following example illustrates the importance of this distinction. Consider a potential project that requires a $1 million investment this year and has a 20-percent chance of success next year. In the event of success, the project yields $5 million in additional revenues, while failure leads to no new revenues. In this case, the undiscounted expected value of the project is $0 and the discounted expected return is negative for any positive interest rate (*i.e.,* accounting for risk and the time value of money). Suppose that the firm nonetheless undertook the project and was successful. It clearly would be a mistake to conclude from the fact that the firm was earning a net return of $4 million ($5 million minus the $1 million investment) that it was somehow earning excess profits that public policy should seek to limit. Such a calculation would fail to account for the fact that the firm had only a 20 percent chance of succeeding and the "large" return in the event of success was necessary for the investment project just to break even in terms of expected value. The existence of such "profits" would

not indicate a competitive problem. Rather, it would illustrate the error in trying to assess *ex ante* investment incentives and the nature of investment competition by looking at *ex post* measures of profits.

33. Notice that applying a risk-adjusted rate of return would not solve the problem associated with using *ex post* profit measures. Consider an investment project that cost $1 million and had only a 20 percent chance of success. In addition, suppose that the risk-adjusted rate of return for projects of this sort is 15 percent. Given that the risk-adjusted rate of return is 15 percent, the firm would require an expected return of $0.15 million in order to be willing to undertake this risky investment. It might seem to be the case that the firm would thus need to earn $1.15 million if its project succeeded. But such a return would be woefully inadequate. The reason is that 80 percent of the time the project will fail and result in a loss of $1 million. This fact means that the firm must anticipate earning much more than $1.15 million in those situations in which its project is successful. Specifically, to have incentive to undertake the investment, the firm would have to anticipate earning $5.75 million in the event of success; $0.15 million = .2 × $5.75 – $1 million.

34. To complete the discussion of this example, suppose that regulators concluded that there was no need for a firm to earn a return of more than 40 percent on its investments and—based on the faulty application of these concepts—limited the firm to earning $1.4 million in the event its investment succeeded. A rational firm would not undertake the investment in these circumstances. The expected value of the project would be –$720,000 (= 0.2 × $1.4 million – $1 million).

35. Because the outcomes of R&D projects are often highly uncertain and can involve large sunk costs, R&D investment is especially susceptible to policies that prevent firms from realizing full returns on their investments. This fact is one of the reasons why the U.S. Constitution created patent policy to provide inventors with intellectual property rights and why patent policy generally does not compel compulsory licensing. Patent policy recognizes that forcing innovators to share their innovations with others reduces the incentives to innovate.

36. Even with strong patent protection, some technological spillover may occur to the extent that one firm can employ the results of research done by another firm without compensation. Because the firm that undertakes the initial research does not account for the benefits accruing to rivals, such spillovers create a divergence between the private and social incentives to invest and can lead to an inefficiently low level of R&D investment.[34] For example, suppose that a wireless carrier is considering whether to undertake promotion, education, or technological activities in support of a particular handset that—in addition to increasing consumer demand for the carrier's services—would benefit any other carrier offering that handset. If there are multiple carriers with the same handset, then the carrier considering whether to undertake the activities may be concerned with free riding by other carriers: the other carriers would benefit from the increased demand for the handset created by the costly support activities, but those carriers would not bear any of the costs of those activities. Such free riding weakens a carrier's incentives to invest in supporting the handset.

---

[34] See Michael L. Katz and Janusz A. Ordover (1990), "R and D Cooperation and Competition," *Brooking Papers on Economic Activity, Microeconomics,* 137-203; Suzanne Scotchmer (2004), *Innovation and Incentives,* Cambridge, MA: The MIT Press, at 269.

Public policies that undermine carriers' abilities to deal with such spillovers would further undermine investment incentives.

B. POLICY PRINCIPLE: THE COMMISSION SHOULD NOT IMPOSE *DE FACTO* INNOVATION TAXES OR SUCCESS PENALTIES

37. Private enterprises have been, and will continue to be, by far the most important sources of innovation and investment in wireless. Thus, it is essential the public policies do not harm private incentives to undertake innovation and investment. Commission policies that have the effect of taxing innovation or punishing successful investment will undermine incentives to invest in new technologies and expanded networks. These considerations are especially important in the light of the fact that many investments in wireless involve large sunk costs and highly uncertain returns.

IV. IN SYSTEMS MARKETS, EFFICIENT COORDINATION AMONG SUPPLIERS OF COMPLEMENTARY COMPONENTS PROMOTES CONSUMER WELFARE

38. Consumers derive benefits from wireless services by making use of several components that work together as a system to provide an integrated offering. As discussed above, these components include the core network, wireless devices, mobile operating systems, and applications. The individual components have little value in isolation but are very valuable in combination. The systems nature of wireless service has important implications for innovation and investment that public policy should take into account.

A. SYSTEMS COMPETITION

39. As discussed in Section V below, competition can drive suppliers to invest and innovate to satisfy consumers' desires. In systems markets, that competition can occur at both the component level and the system level. Competition between different incompatible

systems can be just as important for innovation and consumer welfare as competition within a system.[35] For this reason, it is incorrect to assert that competition is blocked by the lack of common standards or by the existence of exclusive contractual relationships among certain manufacturers of complementary components. In the presence of incompatible standards or exclusive contractual relationships, competition takes place at the system level.

40. Consider the nature of competition when there are exclusive deals between some wireless carriers and handset manufacturers. Innovation by one manufacturer-carrier pair creates powerful competitive pressures for other manufacturers and carriers to meet or beat that innovation. The introduction of the iPhone provides a dramatic illustration of the power of exclusive contracts to spur competitive innovation. The iPhone was the first touch-screen handset widely to capture the public's imagination. As part of the launch of the iPhone, AT&T made several significant investments in its facilities and processes.[36] Since the iPhone's introduction on the AT&T network, there has been a wave of innovative product offerings by rival handset manufacturers and carriers. Consider, for example, product introductions in the last year alone. In the late fall of 2008, Research in Motion and Verizon teamed up to launch the Blackberry Storm, which has a very high resolution touch screen that features tactile feedback, something the iPhone does not have. Google teamed up with HTC to offer the G1 through T-Mobile. The G1 makes use of Android, Google's powerful new

---

35 Michael L. Katz and Carl Shapiro (1994), "Systems Competition and Network Effects," *The Journal of Economic Perspectives* **8**(2): 93-115; Joseph Farrell, Hunter K. Monroe, and Garth Saloner (1998), "The Vertical Organization of Industry: Systems Competition Versus Component Competition," *Journal of Economics & Management Strategy* **7**(2): 143-82.

36 Michael L. Katz, "Measuring Effective CMRS Competition," attachment to "Reply Comments Of AT&T," *Wireless Telecommunications Bureau Seeks Comment On Commercial Mobile Radio Services Market Competition*, WT Docket No. 09-66, July 13, 2009, ¶ 44.

operating system, and offers features such as multimedia messaging that the original iPhone 3G does not. In addition, Sprint distributes Palm's new Pre handset, which features both a touch screen and a slide-out keyboard, and is based on a new operating system offering several powerful, innovative features.[37] Many of these product introductions are seen as direct responses to the competitive challenge posed by AT&T and the iPhone. Moreover, AT&T and Apple have responded to this competition, recently introducing the iPhone 3Gs with several new features, including multimedia messaging.[38]

41. Similarly, it is incorrect to assert that incompatibility among standards eliminates competition. As a general matter, there are costs associated with incompatibility, such as the inability to mix and match components across incompatible systems. However, in industries where there is a wide variety of components on each system, these costs will be relatively low. Moreover, it is important to recognize that there can be value from the product or service variety made possible by the existence of multiple standards. Further, consumers can benefit from systems-level competition among rival standards. This competition can benefit consumers by driving the suppliers of components operating on the different standards to innovate and invest in order to promote the success of their components, in particular, and their systems, overall. Today, for example, there are competing operating systems offered by Apple, Blackberry, Google, Microsoft, Motorola, Nokia, and Palm. This competition drives

---

[37] Sascha Segan, "Palm Pre Review," *PCMag.com*, June 4, 2009, *available at* http://www.pcmag.com/article2/0,2817,2338901,00.asp, *site visited* September 28, 2009.

[38] Apple, "Introducing iPhone 3GS," *available at* http://www.apple.com/iphone/iphone-3gs/, *site visited* September 28, 2009.

OS manufacturers to innovate and to seek various ways to make their systems more attractive to both consumers and application developers.

42. The Commission itself has found that wireless consumers have benefited from standards competition at the network level.

> As a result of the flexibility afforded by the Commission's market-based approach, different U.S. providers have chosen to deploy a variety of different technologies with divergent technology migration paths. Competition among multiple incompatible standards has emerged as an important dimension of non-price rivalry in the U.S. mobile telecommunications market and a distinctive feature of the U.S. mobile industry model…
>
> …In addition, competition between mobile telephone providers using incompatible wireless network technologies has other advantages that can benefit consumers, including greater product variety and differentiation of services, more technological competition, and greater price competition.[39]

B. THE NEED FOR COORDINATION

43. Systems require components that work together to generate meaningful consumer benefits. Thus, there is a need for coordination among component suppliers to ensure that the different complementary components of a system can, in fact, work together. The need for coordination applies on a forward-looking basis as well: in many cases, innovation or investment in one component may create consumer value only if there is also complementary innovation or investment in other components.

44. There are two important aspects of coordination: *communication* and *internalization*. Communication involves sharing information so that individual component suppliers have the information necessary to produce components that can work together. In many instances, this

---

[39] *CMRS Competition Report, 2009*, ¶ 127.

communication takes the form of standards. In the presence of a well-defined standard, a component manufacturer knows that, if it manufactures a product that conforms to the standard, then that product will be able to work with other components conforming to the standard. Of course, extensive communication may be necessary to establish a workable standard. And, in a market subject to rapid technological change and innovation, the suppliers of different components may need to communicate constantly as their products advance. In such markets, formal standard setting may not be a sufficient form of communication to keep up with market developments.

45. Communication is only one element of coordination, and the sharing of information alone is generally insufficient to motivate efficient innovation and investment in complementary components. The reason is that the supply of complements is subject to pecuniary externalities: investments that improve one component are likely to benefit the suppliers of complementary components. Because the supplier of any one component tends to ignore the benefits that it creates for complementary component suppliers, there tends to be underinvestment.[40] Consider, for example, a wireless carrier that is considering a $10 million network upgrade that would improve the performance of a specific handset. Suppose that the upgrade would—for the moment, holding aside its cost—raise the network operator's profits by $8 million. Moreover, suppose that the upgrade would raise the handset manufacturer's profits by $7 million. Collectively, the operator and the handset manufacturer would enjoy a net return of $5 million on the investment. However, absent some sort of compensation from

---

[40] The fundamental logic of this point was first formalized by Augustin Cournot. (*Recherches sur les Principes Mathematiques de la Theorie des Richesses*, Paris: Hachette, 1838. English translation by N. T. Bacon published in *Economic Classics* (Macmillan, 1897) and reprinted in 1960 by Augustus M. Kelly.)

the handset manufacturer, a rational network operator would not make the investment; if it did, the operator would suffer a $2 million loss from the investment ($8 million – $10 million).

46. What is needed is some form of internalization mechanism, whereby the network operator takes into account the investment's benefits to the handset operator. More generally, internalization takes place when there is some sort of institutional arrangement that serves to induce a potential investor to take into account the benefits to other suppliers when making its innovation and investment decisions. As will be discussed below, internalizing institutions can take several forms.

C. INSTITUTIONAL SOLUTIONS

47. When allowed to do so, private parties will respond to these problems by adopting contractual and organizational institutions that facilitate communication and internalization. Various forms of vertical contracting, including vertical integration and different forms of exclusivity arrangements can promote investment in both network infrastructure and complementary equipment and applications.

48. It is widely accepted in legal, public policy, and economic analysis that exclusive contracts frequently promote competition and increase suppliers' incentives to engage in investment and innovation.[41] These effects arise because exclusive contracts provide a means

---

[41] Although there are some circumstances in which exclusive arrangements raise consumer-welfare concerns, elsewhere I show that these conditions do not apply in the case of carrier-handset manufacturer exclusive arrangements. (Michael L. Katz, "An Analysis of Comments Regarding the Economics of Exclusivity Arrangements between Commercial Wireless Carriers and Handset Manufacturers," attachment to "Reply Comments of AT&T," *In the matter of Rural Cellular Association Petition for Rulemaking regarding Exclusivity*

for parties to commit to dealing with one another and, thus, such contracts can increase the incentives for the parties to invest in their economic relationship. By strengthening investment incentives, exclusive contracts promote investment and innovation that might not otherwise occur.

49. Exclusive deals between handset manufacturers and wireless carriers provide a good example of how such arrangements strengthen incentives to innovate and invest. Absent an exclusive arrangement, a carrier has attenuated incentives to make network investments in support of a particular handset model's innovative new features and functions, to promote that model, and to provide customer support for that model of handsets. This is so because absent exclusivity: (a) many of the benefits of these activities would accrue to other carriers offering that model (through what is known as *free riding*); (b) the carrier would be reluctant to make commitments that required high sales volumes to be successful because of concern for insufficient demand (as a result of what are known as *contractual externalities*); and (c) the handset manufacturer would be in a better position to appropriate the benefits of the carrier's investments by using threats to switch the manufacturer's handset distribution to other carriers (a tactic known as *hold up*).[42]

Arrangements between Commercial Wireless Carriers and Handset Manufacturers, RM-11497, February 20, 2009.)

42 The economic forces at work are described in Section II of Michael L. Katz, "An Economic Analysis of the Rural Cellular Association's Petition for Rulemaking Regarding Exclusivity Arrangements between Commercial Wireless Carriers and Handset Manufacturers," attachment to "Comments of AT&T Inc.," *In the matter of Rural Cellular Association Petition for Rulemaking regarding Exclusivity Arrangements between Commercial Wireless Carriers and Handset Manufacturers*, RM-11497, February 2, 2009.

50. The arrangement between Apple and AT&T in the United States provides a good example of how exclusivity can facilitate coordination and promote innovation and investment. AT&T was able to engage in extensive developmental and marketing activities with Apple in connection with the iPhone without fear that other carriers would free ride on AT&T's efforts.[43] Moreover, by ameliorating concerns of contractual externalities and hold up, the exclusive arrangement between Apple and AT&T in the United States created an economic environment in which AT&T was willing to make substantial investments in support of the iPhone. For example, AT&T modified its systems, processes, and procedures to allow a "grab and go" activation model for the original iPhone.[44] Under this innovative activation model, a consumer did not have to wait in the retail outlet while the handset was activated. Instead, a consumer could sit at a personal computer in his or her home or office and activate the handset and choose a rate plan using iTunes software. AT&T also invested in modifications to its network hardware and software to support the iPhone's "visual voicemail" feature and to make use of enhanced callback features.[45] In addition, AT&T provided Apple with sensitive, proprietary information that allowed Apple to improve its distribution and activation model for the 3G version of the iPhone.[46] The exclusive arrangement between AT&T and Apple provided AT&T with the confidence that the sharing of this information with Apple would not undermine AT&T's competitive position or later be

---

43 Interview with AT&T personnel, November 25, 2008.

44 Interview with AT&T personnel, November 25, 2008.

45 Interview with AT&T personnel, November 25, 2008. Visual voicemail provides a visual index of the voicemail messages that a user has received, and it allows him or her to access those messages in any order.

46 Interview with AT&T personnel, November 25, 2008.

used by Apple as a bargaining chip to seek more attractive terms from AT&T in return for not supplying rival carriers while making use of the improved distribution and activation model.

51. Vertical integration (including integration into the supply of complementary inputs) can also stimulate innovation and investment. It can do so in two ways. First, vertical integration can serve as a form of exclusive contracting, giving rise to the benefits described above. Second, vertical integration can internalize what might otherwise be uncompensated spillovers from the investing stage to another stage in the vertical chain. The exact mechanisms by which integration achieves coordination benefits are not fully understood, but some combination of internal governance, the allocation of control rights, and the allocation of rights to income flows are generally recognized as serving to internalize incentives to a large extent. The empirical economics literature has generally found that vertical integration spurs investment. For example, Mullin and Mullin (1997) found that vertical integration induced investments in relationship-specific assets in steel production.[47] Similarly, Ciliberto (2006) found that hospitals that are vertically integrated or that form joint ventures with the physicians, and who thus have full control of their assets (the patients), undertake more investments in healthcare services over time than hospitals that are independent of the physicians.[48] And many observers attribute Apple's innovativeness in the personal computer

---

47 Joseph Mullin and Wallace Mullin (1997), "United States Steel's Acquisition of the Great Northern Ore Properties: Vertical Foreclosure or Efficient Contractual Governance?" *Journal of Law, Economics, and Organization* **13**(1): 74-100.

48 Federico Cilberto (2006), "Does Organizational Form Affect Investment Decisions?," *Journal of Industrial Economics* **54**(1): 64-93. For comprehensive reviews of this literature, see Francine LaFontaine and Margaret Slade (2007), "Vertical Integration and Firm Boundaries: The Evidence," *Journal of Economic Literature* **45**(3): 629; and James Cooper, Luke Froeb, Dan O'Brien, and Michael Vita (2005), "Vertical Antitrust Policy as a Problem of Inference," *International Journal of Industrial Organization* **23**(7-8): 639-659.

industry in part to its integration into the supply of many of the different hardware and software components that make up a personal computer system.

52. There are also other forms of vertical relationships that support innovation and investment. For example, network operators and device manufacturers provide support to independent providers of complementary devices and applications (*e.g.,* Verizon's Open Development Initiative, AT&T's devCentral, and Apple's developer kit). Consumers benefit from the resulting increase in the availability of a variety of access devices and applications. Similarly, the wireless carriers are collaborating with other consumer electronics and industrial firms to embed wireless devices in a variety of common appliances and products in order to facilitate machine-to-machine communication. Both AT&T and Verizon have created labs to coordinate innovations between wireless carriers and other firms.[49]

53. In summary, there is no reason to think that requiring participants in the different layers of the wireless ecosystem to act independently will maximize consumer welfare. Given the interrelated nature of the wireless ecosystem, it is important that makers of complementary inputs be able to coordinate with each other. As just discussed, various forms of private contractual arrangements can be critical to facilitating that coordination by aligning incentives to innovate and invest.

---

[49] AT&T, Press Release, "AT&T Launches Dedicated Certification Lab for Emerging Devices, Reinforces 'Open Innovation' Leadership," September 2, 2009, *available at* http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=27080, *site visited* September 28, 2009; see also, Verizon Wireless, Press Release, "Verizon Wireless LTE Innovation Center To Drive 4G Next Generation Wireless Product Development," April 1, 2009, *available at* http://news.vzw.com/news/2009/04/pr2009-03-31d.html, *site visited* September 28, 2009.

D. MANAGED ECOSYSTEMS HAVE BEEN HIGHLY INNOVATIVE

54. The potential consumer benefits of vertical contractual arrangements and the exercise of control to promote coordinated investment and innovation can be seen through consideration of several prominent examples of managed ecosystems that have been highly innovative. Tight management allows for additional control over quality and systems integration that can lead to a seamless and more desirable consumer experience.

55. Apple's integration into computer hardware and software is one example. Apple OS X is the operating system that runs exclusively on Apple's Mac computers. Since the first version (v 10.0) was released in March, 2001, Apple has steadily released updates to OS X every 12 to 18 months. With each update, Apple has added many new features. For example: Apple introduced Quartz Extreme in version 10.2, which significantly improved OS X graphics;[50] version 10.4 introduced Spotlight Search, a feature that allows users to search files efficiently on their Macs;[51] and version 10.6's applications almost all use 64-bit code, which increases overall performance and makes efficient use of the computer's memory.[52]

56. Apple's OS X is highly regarded and considered to be innovative, in part because it is a component in a tightly managed system.[53] Because Apple controls both the software and the

---

50 CNET Reviews, Apple Mac OS X 10.2 Jaguar, August 20, 2002, *available at* http://reviews.cnet.com/macintosh-os/apple-mac-os-x/1707-3673_7-20284873.html, *site visited* September 28, 2009.

51 Troy Dreier, "Apple OS X 10.4 (Tiger)," May 4, 2005, *available at* http://www.pcmag.com/article2/0,2817,1811493,00.asp, *site visited* September 28, 2009.

52 Apple, "Mac OS X," *available at* http://www.apple.com/macosx/technology/, *site visited* September 22, 2009.

53 Tanner Godarzi, "Why Apple's Proprietary System and Small Market Share Are a Good Thing," January 26, 2007, *available at* http://www.applematters.com/article/why-apples-

hardware, it can more effectively integrate the two and develop the software to take advantage of new features in the hardware. For example, Apple's integrated approach allowed it to optimize its software to take advantage of the switch from 32-bit to 64-bit processors.[54] And Apple has long been seen as providing a superior multimedia experience, which again relies on a coordinated combination of hardware and software.[55]

57. Apple's iPod music device offers another example. The iPod is tightly integrated with Apple's iTunes Store. In October 2001, the first version of the iPod was released by Apple with a maximum capacity of 5GB for music files, whereas the most recent version of the iPod classic has a capacity of 160 GB and can display photos and play videos in addition to music files. The iPod Touch can play video games. The increased capabilities of the iPod family have been developed hand-in-hand with those of the iTunes Store. Consumers can now download movies, televisions shows, and video games from the iTunes Store onto their iPods.

58. NTT DoCoMo provides an example of an innovative and successful managed system in the wireless industry. NTT DoCoMo's i-mode service offered the first wireless system

---

proprietary-system-and-small-market-share-are-a-good-thing/, *site visited* September 28, 2009.

[54] Apple, "Mac OS X," *available at* http://www.apple.com/macosx/technology/, *site visited* September 22, 2009.

[55] Nik Rawlinson, "Macs Are Better Than PCs, Says Channel 5," *MacUser* March 20, 2007, *available at* http://www.macuser.co.uk/news/108183/macs-are-better-than-pcs-says-channel-5.html, *site visited* September 29, 2009; Mike Curtis, "Final Cut Pro 6.0.1," *MacWorld*, June 22, 2007, *available at* http://www.macworld.com/article/58488/2007/06/finalcutpro6.html, *site visited* September 29, 2009; PhoneArena, "Apple iPhone 3GS Review," June 24, 2009, *available at* http://www.phonearena.com/htmls/Apple-iPhone-3GS-Review-review-r_2202-p_3.html, *site visited* September 29, 2009.

based entirely on packet-switching.[56] A year after it first introduced i-mode, NTT DoCoMo also offered the first 3G wireless network in the world. NTT DoCoMo's network is regarded as particularly innovative not just for its technical characteristics, but also for its integrated business model, which was made possible by its technological advances.[57] For example, i-mode's packet-based system allowed users to remain in constant connection with the network. Although i-mode was offered as an open system in that users could visit any compatible site, NTT DoCoMo managed the consumer experience by partnering with approximately 1,000 "official" i-mode web sites. NTT DoCoMo controlled the user interface on consumer handsets, and it designed the interface to allow users to navigate easily among various partners. NTT DoCoMo also handled transaction billing for its partners in an integrated way so that consumers had to pay only one bill. The i-mode service was very successful, attracting more than 10 million subscribers in its first 18 months.[58]

59. The history of video games similarly illustrates the advantages of managed systems. Atari had an open system, which led to many pornographic and/or low quality games. Consumers (and/or their parents) reacted negatively, and the whole system failed as a consequence.[59] In contrast, Nintendo maintained strict quality control over the games that were allowed to be used with its consoles. Consumers benefited from the quality control, as

---

56 John Ratliff, "NTT DoCoMo and its I-mode Wireless Network," STS NEXUS, *available at* http://www.scu.edu/sts/nexus/winter2001/RatliffArticle.cfm, *site visited* September 24, 2009.

57 *Id.*

58 *Id.*

59 See, Adam Brandenburger and Barry Nalebuff (1996), *Coopetition*. New York, NY*:* Bantam Doubleday Dell Publishing Group, at 111.

did the makers of high-quality games.[60] Nintendo and later console manufacturers (who adopted similar strategies) did not limit game innovation (except to the extent that pornographic or low-quality games could be considered "innovative"), nor did console manufacturers preserve "monopoly" positions for themselves as developers of games for their consoles. Instead, console manufacturers allowed many different independent developers to license the rights to sell games on those systems. Moreover, Nintendo and other video game console manufacturers adopted a business model in which they relied on licensing revenues from game developers and subsidized video game consoles in order to promote their adoption.

60. The existence of operators with control over the systems also has played a role in video game innovation. When a video game console manufacturer charges license fees to game developers, the console manufacturer's profits are tied, in part, to the success of various games developed by others. Because its profits depend on both console and game sales, and because it can set common standards for the games that run over its system, a console manufacturer has the ability and incentives to coordinate the transitions to innovative new game systems that are expected to generate significant consumer benefits and resulting game sales. Nintendo's launch of the Wii, with games that make heavy use of its motion-sensitive controllers, is a recent example.

---

60 *Ibid.* at 112-113.

E. POLICY PRINCIPLE: ABSENT CLEAR AND SPECIFIC EVIDENCE OF COMPETITIVE HARMS, PUBLIC POLICY SHOULD NOT UNDULY LIMIT COORDINATION AMONG SUPPLIERS OF COMPLEMENTARY SYSTEM COMPONENTS

61. In summary, wireless services are provided by systems of components that must work together and, hence, there can be large consumer benefits from coordinated innovation and investment by infrastructure manufacturers, wireless carriers, handset manufacturers, operating system developers, and application providers. Absent clear and specific evidence of competitive harms, public policy should not inefficiently limit private sector actions (*e.g.*, contractual or ownership arrangements) that promote increased coordination among suppliers of complementary system components. Antitrust policy provides a tested framework for identifying and preventing competitive harms. Public policy makers should rely upon the antitrust laws, rather than prophylactic bans on broad classes of contractual arrangements, to deal with any exclusive arrangements or other forms of vertical contracting that can in some circumstances be demonstrated to be anticompetitive and harmful to consumer welfare.

V. COMPETITIVE MARKET FORCES CREATE INCENTIVES FOR INVESTMENT AND INNOVATION THAT SATISFY CONSUMER DESIRES

62. Competition policy (including antitrust enforcement and modern telecommunications regulation) is designed to protect competition because of the benefits that competition brings to consumers. These benefits typically come in the form of lower prices, greater variety, or higher product and service quality. Competition can play an important role both in promoting innovation and investment and in ensuring that the benefits of that innovation and investment accrue to consumers.

A. WIRELESS COMPANIES TODAY OFFER A RANGE OF PRODUCTS AND SERVICES TO ACCOMMODATE MANY DIFFERENT CONSUMERS' PREFERENCES

63. I have discussed previously a detailed framework for assessing indicia of effective wireless competition.[61] More recently, Professor Willig has investigated the current state of competition in the wireless industry, and he concluded that **"**competition both in wireless services and in other elements of what the Commission terms the "mobile value chain" is robust, and is poised to remain so in the future."[62] Professor Willig examined competitive conditions in various layers of the wireless ecosystem, including competition among carriers, handset manufacturers, operating systems companies, and application developers, and he concluded that competition is robust in all layers.

64. A brief review of the data provides an indication of the strength of competition and the resulting consumer choice. For example, more than 98 percent of the U.S. population can choose to obtain service from at least three wireless carriers, 94 percent can choose from at least four carriers, and more than half can choose from at least five carriers.[63] A consumer seeking wireless service today could choose from a variety of national and local plans with varying features such as friends-and-family groups, free long distance plans, unlimited calling, and data services options that meet almost any preference for wireless voice and data

---

61 Michael L. Katz, "Measuring Effective CMRS Competition," attachment to "Reply Comments Of AT&T," *Wireless Telecommunications Bureau Seeks Comment On Commercial Mobile Radio Services Market Competition*, WT Docket No. 09-66, July 13, 2009.

62 Declaration of Robert D. Willig, attachment to "Comments of AT&T Inc.," *Wireless Telecommunications Bureau Seeks Comment On Commercial Mobile Radio Services Market Competition*, WT Docket No. 09-66, September 30, 2009 (hereinafter *Willig Declaration*), ¶29.

63 *CTIA Comments* at 3.

usage.[64] Table 5 illustrates this fact by showing the array of wireless plans available from AT&T alone.

Table 5: AT&T Service Plan Options

Individual Plan		FamilyTalk Plan		GoPhone Pick Your Plan		GoPhone Pay As You Go Plan		Data Plan	
Minutes	*Monthly Cost*	*Shared Minutes*	*Monthly Cost*	*Minutes*	*Monthly Cost*	*Cost per Minute*	*Daily Access Fee*	*Data*	*Monthly Cost*
200	$29.99	550	$59.99	200	$29.99	$0.00	$3.00	BlackBerry Personal	$35.00
450	$39.99	700	$69.99	300	$39.99	$0.10	$1.00	BlackBerry Personal plus Tethering	$65.00
900	$59.99	1400	$89.99	400	$49.99	$0.25	N/A	PDA Personal	$35.00
1350	$79.99	2100	$109.99	650	$69.99			PDA Personal plus Tethering	$65.00
Unlimited	$99.99	3000	$149.99					DataConnect 200 MB	$40.00
		4000	$199.99					DataConnect 5 GB	$60.00
		Unlimited	$199.99						

Notes: Minutes shown for voice plans come with, in most cases, unlimited nights/weekends and mobile-to-mobile calls. The monthly cost for the FamilyTalk Plan includes the first two lines; additional lines are $9.99 each. GoPhone Pay As You Go Plan daily access fee applies only to days with phone usage. 200 minute Individual Plan only available to seniors. Service plans presented are specific to zip code 20817, and do not reflect all plans offered by AT&T.

Source: http://www.wireless.att.com/cell-phone-service/cell-phone-plans/index.jsp, site visited September 17, 2009.

65. Carriers also offer multiple contractual term arrangements. For example, the four largest wireless carriers all offer new customers two-year contracts with pro-rated early termination fees.[65] AT&T offers customers that bring their own compatible handsets to the network a month-to-month service option.[66] Similarly, Verizon offers a month-to-month service option to consumers who are willing to pay full retail price for a handset or provide their own.[67]

66. Consumers have a wide array of choices among handsets. In the U.S., consumers can choose among hundreds of different handsets produced by more than 30 manufacturers.[68]

---

64 *CTIA Comments* at 24.

65 *CMRS Competition Report, 2009*, ¶ 114.

66 AT&T, Press Release, "AT&T Announces Third Annual CTIA Wireless Events to Encourage Development of Innovative Wireless Applications for Consumers and Businesses," March 18, 2008, *available at* http://www.att.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=25332, *site visited* September 29, 2009.

67 *CMRS Competition Report, 2009*, ¶ 115.

68 *CTIA Comments* at 31-32.

These devices offer a wide range of capabilities, from relatively simple phones to smart-phones that include Internet browsers and email clients. Many of these phones are designed to take advantage of the latest innovations in the core network. For example, 29 handsets in the U.S. have integrated Wi-Fi capability.[69]

67. Finally, as already discussed in Section II.B.1, consumers benefit from a variety of choices in operating systems and easy access to tens of thousands of applications from various providers.

B. COMPETITION PROMOTES INNOVATION (WHEN INTERNALIZATION IS ALLOWED AND PROPERTY RIGHTS ARE ESTABLISHED)

68. It is generally accepted amongst economists that competition promotes innovation as long as firms can internalize the returns to their investment. Firms facing strong rivals have an incentive to develop new products in order to maintain their market position.[70] However, they are more likely to do so when they are allowed to internalize the returns to their investment. As discussed above, internalization often requires exclusive contracts or other forms of vertical integration and coordination. For example, as also discussed above, the introduction of the iPhone is generally credited with spurring innovation among competing

---

69 *CTIA Comments* at 32.

70 See, *e.g.*, Suzanne Scotchmer (2004). *Innovation and Incentives*, Cambridge, MA: The MIT Press, at 169; Michael L. Katz, and Howard A. Shelanski, (2007), "Mergers and Innovation," *Antitrust Law Journal*, **74**(1): 1-85. Economists have also noted that in some cases, high market shares can spur innovation. (See, *e.g.*, Michael L. Katz, and Howard A. Shelanski, (2007), "Mergers and Innovation," *Antitrust Law Journal*, **74**(1) at 19. "The possibility of sudden and sweeping entry, combined with large up-front investment demands, can necessitate high initial returns to allow costs to be recouped before the next innovator supplants the incumbent investor. A firm with a large market share and significant market power may better amortized the fixed costs of R&D and reap a high percentage of the benefits of R&D. large, established firms might be particularly adept at marshaling resources for incremental innovation or for helping to bring a small firm's invention to market.")

handset manufacturers and facilities-based carriers to offer new, advanced handsets and improved networks.[71] The introduction and success of the iPhone were facilitated by the exclusive contract between AT&T and Apple.

C. REGULATORY POLICIES THAT DISTORT COMPETITION CAN UNDERMINE INNOVATION AND INVESTMENT

69. In thinking about the effects of public policy on competition, it is essential to recognize a fundamental distinction between protecting the competitive process and protecting individual competitors from the rigors of the marketplace. Or, as is commonly stated, competition policy is concerned with harm to competition, not harm to competitors. The following hypothetical example makes clear why this distinction is so important. Suppose that a supplier invests in an innovative, new, proprietary product that is extremely attractive to consumers. The introduction of that innovative product harms competitors because they will lose sales and profits to the innovative supplier or will have to spend resources to respond with competitive offerings of their own. But the innovation benefits consumers and is, indeed, an example of the competitive process in action. Competition policy properly favors innovation and seeks to protect competition. A policy that sought to protect competitors might block the introduction of innovative products. Alternatively, a pro-competitor policy might require that any such innovation be shared with rivals, thus greatly weakening or even destroying innovation incentives. In either case, a policy that sought to protect competitors would harm competition and consumer welfare.

---

[71] Maria Bartiromo, "Eric Schmidt on Where Google is Headed," *BusinessWeek*, August 6, 2009, *available at* http://www.businessweek.com/magazine/content/09_33/b4143011785548.htm, *site visited* September 28, 2009.

70. The consumer and efficiency benefits of public policies that encourage competition in products and services—as well as technology choice and business model design—are particularly great for wireless broadband, where there is extensive, ongoing innovation and investment that has the potential to change the way people use wireless devices in fundamental ways.

71. Regulatory policy should allow competitive forces to work in establishing winners and losers rather than interfering in such a complex industry. Public policy should not impose policies that protect weaker competitors and handicap stronger competitors. Furthermore, regulatory policy should not substitute for wireless providers' business judgments about how best to manage their networks as long as those judgments are subject to vigorous antitrust review.

72. Case-by-case application of antitrust laws is the best way to deal with the concern that there are some circumstances in which vertical contracting and other business practices can be used to harm competition. A case-by-case approach is the only way to block the use of these practices when they harm competition and consumers while at the same time ensuring that providers can engage in these practices in the many instances where they benefit consumers and promote competition, innovation, and investment. This approach is very different than one of imposing prophylactic bans on broad classes of arrangement (*e.g.,* a flat ban on handset exclusivity arrangements without regard for the specific competitive conditions under which an arrangement operates) or a policy enforcement regime that relies upon ad hoc regulatory determinations of "reasonableness" that are largely unpredictable and are undisciplined by established and well-developed antitrust doctrine.

D. POLICY PRINCIPLE: THE COMMISSION SHOULD ADOPT POLICIES THAT PROMOTE AND PROTECT COMPETITION, NOT DISTORT IT.

73. To summarize, in a competitive marketplace, those companies that successfully satisfy consumers' needs and desires earn the greatest financial returns. Competition thus drives firms to act to the benefit of consumers. Consequently, policies that protect competition serve to promote consumer welfare. Conversely, policies that distort competition—and that protect competitors rather than competition—generally harm consumer welfare. To further its goal of promoting wireless innovation and investment, the Commission should thus adopt policies that promote and protect the competitive process, allowing consumer preferences to determine winners and losers in the marketplace.

VI. POLICY PRINCIPLES APPLIED TO SELECTED WIRELESS ISSUES

74. Public policy can promote innovation and investment, both directly, by removing obstacles, and indirectly, by stimulating competition. However, public policy can also stifle and distort innovation and investment. The discussion above identifies four guiding principles for public policy in this area:

- *Consumers are best served when public policy promotes efficient innovation and investment in all parts of the wireless ecosystem;*
- *The Commission should not impose de facto innovation taxes or success penalties;*
- *Absent clear and specific evidence of competitive harms, public policy should not unduly limit coordination among suppliers of complementary system components; and*
- *The Commission should adopt policies that promote and protect competition, not distort it.*

75. There are many policies either now in place or under consideration to which some or all of these principles apply. In this section, I consider how these principles can be used to guide policy making.

A. EXCLUSIVITY

76. As already discussed above, consumers have benefited from exclusive dealing arrangements between wireless carriers and handset makers. This is so for at least two reasons. First, the introduction of exclusive handsets is an important form of competition in this industry. Handset manufacturers and wireless carriers work together to create innovative new products that allow them to gain (typically temporary) competitive advantages over their rivals. Innovation by one manufacturer-carrier pair creates competitive pressure for other manufacturers and carriers to meet or beat that innovation. Second, exclusive deals between handset manufacturers and wireless carriers strengthen carriers' incentives to make network investments in support of innovative new handset features and functions, to promote new handsets, and to provide customer support for those handsets. Absent exclusivity, a carrier could have reduced incentives to engage in these competitive activities in support of a handset model because of the free-riding, contractual externality, and hold up concerns discussed in Section IV.C above.

77. One recent proposal would limit the ability of carriers and handset manufacturers to enter into exclusive contracts. In support of the Rural Cellular Association's *Petition for Rulemaking Regarding Exclusivity Arrangements Between Commercial Wireless Carriers and Handset Manufacturers*, Professor Rogerson proposed that exclusive arrangements be allowed between the "big-four" wireless carriers (AT&T, Sprint, T-Mobile, and Verizon) and handset manufacturers, but that the exclusivity provisions apply only with respect to other

members of the big four.[72] Professor Rogerson asserts that this proposal would reduce the harms that he claims result from exclusive contracts while maintaining incentives to innovate. In particular, Professor Rogerson asserts that innovation and investment decisions by the big-four carriers are "substantially determined" by competition among each other. Therefore, by his logic, policies that impose restrictions on how the big four compete with other wireless carriers would have no impact on innovation and investment.

78. Professor Rogerson's proposal is unworkable and would undermine innovation and investment incentives. Specifically, there are several problems with his proposal. First, Professor Rogerson makes inconsistent claims about the extent to which small- and medium-sized carriers provide competitive constraints on the big-four carriers. On the one hand, he claims that the competitive strategies of the big four are substantially determined by interaction with each other.[73] On the other hand, he claims that in rural areas, small- and medium-sized carriers often provide the "most significant competition" for the big four.[74] To the extent that smaller carriers do not provide a competitive constraint, the exclusive contracts are unlikely to have an anticompetitive effect. To the extent that small- and medium-sized carriers do provide competitive pressures on the big four, exclusive contracts promote competition and benefit consumers for the reasons discussed earlier in this white paper. For

---

72 William P. Rogerson, "An Economic Analysis of Exclusivity Arrangements between the Big Four Wireless Carriers an Handset Manufacturers and a Proposal for a Modest Restriction of these Exclusivity Arrangements," *In the matter of Rural Cellular Association Petition for Rulemaking Regarding Exclusivity Arrangements between Commercial Wireless Carriers and Handset Manufacturers*, RM-11497, May 20, 2008 (hereinafter, "Rogerson Report"), at 14-16.

73 Rogerson Report at 15-16.

74 Rogerson Report at 8-9.

example, to the extent that marketing activities are local, big-four carriers would have less incentive to engage in promotional and other activities that would be subject to free-riding because they would not be able to internalize all of the returns to their investment.

79. Second, the proposed rule is arbitrary and ignores the dynamic nature of the wireless industry. Professor Rogerson suggests that the big four should be subject to this regulation because they collectively account for 86 percent of subscribers in the U.S. However, when thinking about the possibility of other carriers' free riding on its investment decisions, a carrier subject to Professor Rogerson's rule would rationally take into account the shares of all of the carriers the could free ride. On a nationwide basis, the combined share of those carriers outside the big four is larger than that of T-Mobile.[75] Professor Rogerson does not offer a sound basis for making his determination that all wireless carriers outside of the big four should be eligible to override exclusive arrangements made between members of the big four and handset manufacturers. He also fails to explain why the problems he asserts arise from exclusive handset arrangements would not equally arise if one of the smaller carrier were to enter into an exclusive arrangement for a highly desirable handset.[76]

80. Furthermore, the wireless industry is a dynamic one. For example, Leap Wireless and Metro PCS are among the fastest growing carriers in the country in the past year.[77] To the

---

75 T-Mobile has a national share of 11.3 percent while the combined share of non-Big Four carriers is 14 percent. (Rogerson Report, Table 1.)

76 Professor Rogerson asserts that exclusive handset arrangements result in: (a) limited or no access to sophisticated handsets in rural areas; (b) reduced intensity of competition between wireless carriers in rural areas; (c) impediments to the roll-out of 3G and 4G networks in rural areas; and (d) barriers to entry by smaller competitors. (Rogerson Report at 7-11.)

77 Morgan Stanley, "Telecom Services 1Q Trend Tracker: Earnings Resilience Supports Outperformance Potential," June 5, 2009, at 53, 57.

extent that the proposed rule would allow these carriers to free ride to gain competitive advantage, the innovation and investment incentives of the big-four wireless carriers and handset manufacturers would be reduced. The threat of free riding from carriers that today have relatively small shares can be expected to induce carriers to invest less than the amount that they otherwise would.

81. Finally, even in the absence of exclusive contracts, a handset manufacturer can have incentives to limit the set of carriers that sell its handset to those carriers whose networks and customer support systems will provide a high-quality user experience that allows the handset to perform up to its capabilities.[78] Some carriers may lack the necessary ability or infrastructure, or the carriers may be unwilling or unable to provide credible commitments to offering the levels of effort the handset manufacturer desires. As part of a sound business strategy, a handset manufacturer may refuse to deal with carriers that do not meet its requirements. This fact has two important consequences. First, attempts to impose Professor Rogerson's proposed policy would very likely lead to protracted and highly contentious disputes about whether a carrier had been denied access to a particular handset because that handset's manufacturer had made an independent decision to do so, or because of the undue influence of the big-four carrier with which the handset manufacturer had a limited exclusive arrangement. Second, even a complete ban on exclusive contracts between handset

---

78 See Michael L. Katz, "An Analysis of Comments Regarding the Economics of Exclusivity Arrangements between Commercial Wireless Carriers and Handset Manufacturers," attachment to "Reply Comments of AT&T," *In the matter of Rural Cellular Association Petition for Rulemaking regarding Exclusivity Arrangements between Commercial Wireless Carriers and Handset Manufacturers*, RM-11497, February 20, 2009.

manufacturers and wireless carriers would not result in all handsets' being available to rural carriers.

B. NET NEUTRALITY

82. Net neutrality has been one of the most hotly debated areas of public policy. Many of the proposed regulations falling under the catch-all title of network neutrality fail to adhere to the principle of protecting competition rather than distorting it. Net neutrality proponents apparently seek to give the application layer a privileged position. Particularly in the light of the tremendous innovation and investment that historically has occurred in wireless core networks and handsets—and the potential for continued innovation and investment in the future—such an approach risks tremendous harm to consumer welfare.

83. In a recent speech, Commission Chairman Genachowski voiced his support for a certain business models at the expense of others. In part, he asserted that

> [t]he Internet's creators didn't want the network architecture -- or any single entity -- to pick winners and losers. Because it might pick the wrong ones. Instead, the Internet's open architecture pushes decision-making and intelligence to the edge of the network -- to end users, to the cloud, to businesses of every size and in every sector of the economy, to creators and speakers across the country and around the globe.[79]

There are several things wrong with using this assertion to support the regulation of broadband service providers. One of the most fundamental is that—from the perspective of promoting innovation, investment, and consumer welfare—there is no one right choice of network architecture, modularity, business model, and network management to which all

---

[79] Julius Genachowski, "Preserving a Free and Open Internet: A Platform for Innovation, Opportunity, and Prosperity," September 21, 2009, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-293568A1.pdf, *site visited* September 28, 2009 (hereinafter, *Genachowski Net Neutrality Speech*) at 1-2.

firms should adhere.[80] There is no general theorem that says having "dumb pipes" best promotes consumer welfare.[81] Second, while at the same time asserting the value of openness and experimentation, the Chairman's proposed approach (discussed below) would put a single entity in charge of picking winners and losers—the Commission.

84. The notion that innovators at the edge are free to pursue whatever business models they choose and to innovate without permission appears to be inconsistent with the Commission's current net neutrality approach. Recently, Google alleged that Apple would not allow a particular Google application on Apple's iPhone edge device.[82] The Commission questioned Apple about its actions. The Commission did not restrict itself to asking if the complementary wireless service provider, AT&T had forced or induced Apple to exclude the Google application. Instead, the Commission demanded to know why Apple was making its business decisions.[83] If openness means openness to alternative business models, then Apple should be free to control the user interface and experience on its phones. Given the underlying market conditions, consumer welfare is served by allowing Apple to create an

---

80 *Katz Broadband Declaration* at 29-37.

81 Indeed, there are economic analyses that establish conditions under which "differentiated pipes" promote consumer welfare by supporting increased network competition. See Testimony of George S. Ford, Ph.D., Chief Economist, Phoenix Center for Advanced Legal & Economic Public Policy Studies, Before the Federal Communications Commission Open Meeting on Network Neutrality and Broadband Network Management, Stanford University, April 17, 2008, at 6. See also Benjamin E. Hermalin and Michael L. Katz, "Product Differentiation through Exclusivity," unpublished manuscript.

82 Reuters, "Google Says Apple Rejected Voice App for iPhone," September 18, 2009, *available at* http://www.reuters.com/article/technologyNews/idUSTRE58H42C20090918, *site visited* September 28, 2009. Apple denies that it has rejected the Google application. (See *Id*.)

83 Letter from James D. Schlichting, Federal Communications Commission, to Catherine A. Novelli, Apple Inc., RE: Google Voice and related iPhone applications, July 31, 2009.

integrated package of features and applications that it offers to the market in competition with a wide range of handsets, operating systems, and applications stores.

85. In his recent speech, Chairman Genachowski announced his intention to impose a non-discrimination requirement on broadband providers. He characterized it as follows:

> The fifth principle is one of non-discrimination -- stating that broadband providers cannot discriminate against particular Internet content or applications. This means they cannot block or degrade lawful traffic over their networks, or pick winners by favoring some content or applications over others in the connection to subscribers' homes. Nor can they disfavor an Internet service just because it competes with a similar service offered by that broadband provider. The Internet must continue to allow users to decide what content and applications succeed.[84]

This statement raises several troubling issues, particularly when applied to wireless networks. For example, would it be unlawful discrimination if a wireless carrier reached a contractual agreement with a particular smart phone manufacturer under which, in return for a large handset subsidy or other investments by the carrier, the manufacturer would agree not to allow certain applications that competed with the carrier's services?[85] And would such an arrangement be unlawful discrimination even if the providers of those particular applications had extensive and varied alternatives for reaching consumers, or if other marketplace factors confirmed that there was no conceivable harm to competition from the contractual arrangement between the carrier and the handset manufacturer? If so, then a central implication of the Chairman's principle is that the Commission will decide which business models succeed or fail, not the ability of those business models to satisfy consumer desires. It

---

[84] *Genachowski Net Neutrality Speech* at 5.

[85] One could also ask how the principle would apply if a broadband service provider decided to enter the market with its own handset? Would the Commission ignore the competitiveness of handset market and impose its non-discrimination requirement on that handset?

is easy to see that this policy fails the broader principle that public policy should not distort competition. It is difficult to see how distorting competition in this way could be considered to be a pro-consumer policy.

86. This last point is sufficiently important that it is worth considering an example in detail. Apple's iTunes App Store includes a version of the Skype VoIP application that allows iPhone owners to use that application over Wi-Fi. Skype and others have publicly complained that the Apple App Store does not support a version of the Skype application that also runs over AT&T's 3G network. Some people have asserted that this refusal is anticompetitive, particularly if undertaken at AT&T's request. For the sake of argument, suppose that Apple would have been indifferent to or even in favor of offering the Skype application absent incentives provided by AT&T to deny the application. Even in that case, the assertions of harm to competition would be misplaced. First, AT&T offers many other handsets that run the Skype application over both Wi-Fi and AT&T's 3G network.[86] Second, Skype can also compete by being offered on handsets operating on competing networks. A theory of anticompetitive exclusionary behavior—that the Skype application is foreclosed in some competitively meaningful way—simply does not fit the facts of the wireless marketplace.

87. A theory that does fit the facts is the following one. It is my understanding that AT&T provides a very large subsidy on each iPhone sold. That subsidy is almost certainly one of the

---

[86] Michael L. Katz, "Measuring Effective CMRS Competition," attachment to "Reply Comments Of AT&T," *Wireless Telecommunications Bureau Seeks Comment On Commercial Mobile Radio Services Market Competition*, WT Docket No. 09-66, July 13, 2009, ¶ 45.

reasons that the iPhone has been so widely adopted by consumers. It is economically rational for AT&T to promote consumer adoption by offering such a subsidy only if AT&T can expect to earn a return on that investment. That return comes through service revenues. If those revenues would be significantly diminished by the presence of the Skype application, then AT&T's incentives to promote iPhone adoption would be diminished as well. In addition to distorting competition among different business models, forcing AT&T to allow Skype to free ride on its investment in the iPhone would amount to a tax on success—because the AT&T-Apple business model was so successful, those parties would be forced to share the benefits of their investments and innovation with Skype. The long-term consequences of such public policies would be to undermine innovation and investment incentives.

88. The Chairman's statement quoted above is troublingly vague about what constitutes an Internet service and discrimination. Does this rule imply that any wireless handset that operates on a broadband network must contain an Internet browser? What determines whether something falls within the category of "Internet content or applications" as opposed to some other type of content or application delivered over broadband? The Chairman apparently recognizes some of these problems, having stated

> I also recognize that there may be benefits to innovation and investment of broadband providers offering managed services in limited circumstances. These services are different than traditional broadband Internet access, and some have argued they should be analyzed under a different framework. I believe such services can supplement -- but must not supplant -- free and open Internet access, and that we must ensure that ample bandwidth exists for all Internet users and innovators.[87]

---

[87] *Genachowski Net Neutrality Speech* at 5.

It is difficult to see how stating that managed services can supplement but not supplant Internet access can result in anything other than regulation of carrier capacity and how that capacity is allocated among services. Again, the Chairman's proposed course of action appears to be to supplant consumer judgments with his own and to violate the principle of not distorting competition.

89. In his recent speech, the Chairman also stated that he "will propose that the FCC evaluate alleged violations of the non-discrimination principle as they arise, on a case-by-case basis, recognizing that the Internet is an extraordinarily complex and dynamic system."[88] Elsewhere in this white paper, I have advocated the case-by-case application of antitrust principles. More generally, a case-by-case approach offers several benefits *when there are clearly articulated and understood principles underlying the case-by-case examination*. In the presence of such principles, policy enforcers can fine tune their decisions to the specifics of the situation while at the same time providing clear guidance to private decision makers. The presence of such principles, and their long history of application, is one reason that this approach has been successfully applied in the area of antitrust enforcement. There is now ample precedent, and although application of the antitrust statutes has evolved as our understanding of the economics of competition has evolved, there has been a high degree of continuity.

90. It is critical to recognize that the conditions necessary for the successful application of a case-by-case approach in the net neutrality context will not be met unless the Commission is far more specific and clear than it is at all likely to be. The likely failure of a case-by-case

---

[88] *Genachowski Net Neutrality Speech* at 5.

approach to the enforcement of a new non-discrimination principle stems from several factors. First, a general statement that "broadband providers cannot discriminate against particular Internet content or applications" is exceptionally vague.[89] In addition to the issues already discussed above, Commission experience in other areas shows that what practices constitute "discrimination" or "reasonable" discrimination can be very contentious and highly dependent upon the circumstances. The rapid pace at which the wireless marketplace is evolving—both in terms of technologies and consumer needs and demands—further complicates matters, as does the lack of any history in applying this new principle to wireless broadband providers.

91. It is thus highly improbable that the Commission will be able to articulate a clear and unambiguous set of principles to serve as guidelines that would allow a broadband service provider to predict with any certainty how the Commission will judge it. The result will be to create unnecessary uncertainty and risk for potential innovators and investors. Thus, for the reasons discussed in Section III above, the predictable consequence will be to reduce innovation and investment by wireless service providers.

92. The Chairman also articulated "a transparency principle -- stating that providers of broadband Internet access must be transparent about their network management practices."[90] Transparency about network management practices can promote competition and consumer welfare by allowing consumers to make better-informed choices. However, it does not follow that Commission-mandated transparency regulations will best serve consumer interests.

---

89 *Genachowski Net Neutrality Speech* at 5.

90 *Genachowski Net Neutrality Speech* at 5.

93. There are several issues that must be considered in order to develop a pro-consumer approach. First, there is a very real question of whether the Commission should be the agency to impose any such rules. The Federal Trade Commission has much more experience and expertise, and because of its broader mandate is less likely than the Federal Communications Commission to serve special interests. There is also a question of whether sector-specific rules are appropriate. A considerable advantage of economy-wide rules is that a well-developed body of case law and precedent has been developed, which provides a less uncertain environment for investors and innovators.

94. Whichever agency undertakes the regulation of service provider disclosure will face some difficult issues. It is certainly a good principle that broadband service providers should not mislead their users. But suppose a broadband service provider adopts the following, publicly stated policy: "At our discretion, we will block high-bandwidth applications."[91] Moreover, suppose that the service provider is able to attract a large number of consumers after making such a statement. Would that be a sufficient level of disclosure from the perspective of public policy makers? If not, why not? There would be no deception by the service provider and, by hypothesis, large numbers of consumers would be satisfied with the policy. If the Commission required additional disclosure, how much detail would be enough? Would the company have to disclose an exact algorithm for when it limits high-bandwidth applications?

---

[91] This example assumes that the Commission does not adopt the view that limiting all applications' use of bandwidth would somehow be a form of discrimination.

95. The Chairman has stated his intention to "pose a series of detailed questions on how the Internet openness principles should apply to mobile broadband."[92] Any analysis of the effects of imposing regulation on the wireless industry should take into account: (a) the much greater need for network management given the higher costs of capacity than in wireline networks; (b) the fact that the relationship between a wireless access device and the network is much more complex than the relationship between an access device and either the wireline pubic switched telephone network or the fixed Internet, which affects both the need for network management and the value of coordination across the value chain; and (c) the degree of competition among wireless providers.

96. Lastly, the Chairman correctly predicts that "Some will seek to invoke innovation and investment as reasons not to adopt open Internet rules."[93] He then asserts that "history's lesson is clear: Ensuring a robust and open Internet is the best thing we can do to promote investment and innovation."[94] But there is a fundamental error in the leap to the conclusion that the road to innovation and investment is government regulation. A reliance on history interpreted in this way would imply that *the Commission should not begin regulating the wireless industry because that industry has been a tremendously successful generator of innovation and investment to date.*

C. MANDATORY SHARING

97. There are several public policies that force firms to share the fruits of their past investments with other firms. There are two related mechanisms through which a mandatory

---

92 *Genachowski Net Neutrality Speech* at 7.

93 *Genachowski Net Neutrality Speech* at 7.

94 *Genachowski Net Neutrality Speech* at 7.

sharing obligation weakens the investment incentives of the party subject to the obligation. First, the party undertaking the costly investment generates benefits for other parties for which the spending party is not fully compensated (if it were fully compensated, the investor would share its assets voluntarily). Second, to the extent that the beneficiaries of the compulsory sharing are product-market rivals that use the shared assets to increase the intensity of their competitive activities, the sharing harms the investor. Both of these effects diminish the incentives to undertake the activity subject to mandatory sharing.

98. It is worth noting that the adverse consequences of mandatory sharing can be particularly acute when there is a high degree of marketplace uncertainty and investments are risky, such as with R&D projects. An example illustrates how a public policy can harm investment and innovation incentives by forcing a firm to share with its rivals its facilities, intellectual property, or other fruits of its successful investments. Consider a project that costs $1 million and, if successful, increases the investor's revenues by $6 million. Suppose that the project has a 20 percent chance of success and, in the event of failure, yields no increase in revenues. The expected value of the project is $200,000 = 0.2 × $6 million – $1 million. The firm would undertake the project as long as its risk-adjusted rate of return is less than 20 percent. Now, suppose that, in the event that its investment project is successful, the investing firm has to share the results of that investment with rival suppliers, say for a fee of $1 million. However, also suppose that the resulting increase in competition lowers the increase in the investor's product-market revenues to $4 million, instead of $6 million. When considering whether to invest under such a public policy regime, the firm will anticipate a return of $0 = 0.2 × ($4 million + $1 million) – $1 million and thus would not invest at any positive interest rate. In short, a regulatory policy that forces the investor to bear all of the

risks of its investment project but socializes the benefits associated with that investment will have especially pernicious effects.

D. LICENSING OF ADDITIONAL SPECTRUM

99. One important way in which Commission policies can promote wireless innovation and investment is by licensing increased amounts of spectrum. The licensing of additional spectrum would stimulate innovation and investment both directly and indirectly.

100. The licensing of additional spectrum would stimulate innovation and investment directly by making available increased amounts of an important input. With additional spectrum available, the costs of offering new services and expanding the supply of existing services would be reduced. Lowering costs in this fashion would increase the expected financial returns to innovation and investment aimed at satisfying consumer desires and, as discussed in Section III above, would thus stimulate that innovation and investment.

101. The licensing of additional spectrum would stimulate innovation and investment indirectly by increasing competition among the suppliers undertaking innovation and investment.[95] It is critical to recognize that, although the entry of new suppliers could be expected to increase competition, the licensing of additional spectrum would also be expected to increase competition even if no new entry took place. The latter form of increased competition would arise for the following reason. With additional spectrum available, an existing competitor that was seeking to gain competitive advantage over its rivals through a combination of innovation and investment would have available to it the spectrum necessary to expand its sales as it successfully attracted additional consumer patronage. This increased

---

[95] See Section V above.

ability to take business away from each other could be expected to stimulate competition among service providers, thus strengthening their incentives to undertake innovation and investment.

102. There are other elements of spectrum policy that are complementary to making additional spectrum available for license. One such element is the degree of flexibility in licensing terms. In recent years, the Commission has pursued an approach of granting licensees increased flexibility in terms of what services they offer. This approach allows market forces to play the lead role in determining what services are offered and consumed. Hence, consistent with the policy principle stated above, this approach promotes competition rather than distorting it. The Commission should also continue to explore and implement steps that can improve the efficiency of secondary markets for spectrum licenses. Promoting voluntary exchange among private parties promotes competition, while—as just discussed above—mandatory sharing is likely to distort competition and to act as an innovation or investment tax.

103. As discussed above and in a white paper by Professor Willig in another proceeding, the Commission's policies of licensing additional blocks of spectrum, allowing flexibility to licensees in terms of how the spectrum is used, and facilitating secondary markets to buy and sell spectrum licenses have been successful in promoting innovation and competition in the wireless industry over the past 25 years.[96] The Commission should continue to pursue these policies.

---

[96] *Willig Declaration* at ¶ 32.

E. SPECTRUM CAPS

104. In contrast, the Commission should not pursue a policy of imposing spectrum caps. Spectrum caps act as a tax on success and can distort and limit competition. A binding spectrum cap can increase the costs of expansion for a service provider that has developed a successful business model that requires additional spectrum to meet consumer demand for its services. A spectrum cap therefore punishes success and, thus, discourages firms from competing to attract consumers through improved services and lower prices.

105. There are several mechanisms through which a binding spectrum cap would harm competition and consumers, and would lead to economic inefficiency. Many of these mechanisms could lead to higher prices.[97] However, the harms to competition and consumers would not be limited to static effects. Innovation would also be harmed. To see why, consider a carrier that was deciding whether to develop and introduce a new service or device that was projected to be very popular with consumers and would increase the carrier's need for spectrum. If the spectrum cap were a binding constraint on the carrier, then it would find it more difficult and/or costly to introduce the new service or device. For example, if a carrier were to introduce the new service while being unable to expand its network capacity, the new service might lead to network congestion and service degradation. The result would be to weaken innovation incentives and discourage dynamic competition.

106. Some parties have called for limitations on successful wireless carriers' ability to obtain additional spectrum on the grounds that such limits are necessary to protect rural

---

[97] See Michael L. Katz, "An Economic Analysis of the Rural Telecommunications Group's Proposed Spectrum Cap," *In the Matter of Rural Telecommunications Group, Inc. Petition for Rulemaking To Impose a Spectrum Aggregation Limit on all Commercial Terrestrial Wireless Spectrum Below 2.3 GHz*, December 2, 2008 (hereinafter, *Spectrum Cap Paper*) at 1,3-4.

consumers.[98] These parties, however, have presented no evidence that small and rural carriers are unable to obtain sufficient spectrum on commercial terms.[99] Indeed, the Commission has found that "significant spectrum is available in rural areas for the provision of new mobile wireless services to consumers."[100]

107. Similarly, some parties have alleged that holders of large amounts of spectrum are engaging in anticompetitive hoarding.[101] As I have discussed elsewhere, this argument fails on two counts.[102] First, other Commission policies and federal antitrust statutes are already in place to address any anticompetitive exclusion by the carriers. Second, these arguments ignore the fact that warehousing spectrum would be both costly and subject to free riding, making it unlikely to be of real concern. Furthermore, as the total amount of spectrum available increases, it becomes even more costly to engage in anticompetitive hoarding.

VII. CONCLUSION

108. The Commission should employ a customer-centric approach to broadband policy generally and to policies that address wireless innovation and investment in particular. The proper focus of a pro-consumer policy is on harm to competition. A true pro-consumer approach will lead to policies that rely primarily on competition with an antitrust and consumer protection backstop to deliver innovation and investment.

---

98 Rural Telecommunications Group, Inc., *In the Matter of Rural Telecommunications Group, Inc. Petition for Rulemaking To Impose a Spectrum Aggregation Limit on all Commercial Terrestrial Wireless Spectrum Below 2.3 GHz*, Petition for Rulemaking, filed July 16, 2008 (hereinafter, *RTG Petition*).

99 See *Spectrum Cap Paper* at ¶¶ 22-25.

100 *CMRS Competition Report, 2009* at ¶ 108.

101 *RTG Petition* at 19.

102 *Spectrum Cap Paper* at ¶¶ 26-28.

109. In closing, it should be noted that it is far from evident that sector-specific policies for antitrust and consumer protection are needed or beneficial. The Commission should seriously examine the extent to which its functions duplicate those of agencies with broader mandates. Instead of duplicating functions better handled by other agencies on an economy-wide basis, the Commission should focus on an area in which it has unparalleled authority and expertise: spectrum policy. Here, too, the central aim should be to facilitate undistorted competition.

VIII. APPENDIX: QUALIFICATIONS

110. I hold the Sarin Chair in Strategy and Leadership at the University of California, Berkeley, where I serve as Director of the Institute for Business Innovation and have a joint appointment in the Haas School of Business Administration and the Department of Economics. I have also served as the Harvey Golub Professor of Business Leadership at New York University's Stern School of Business and on the faculty of the Department of Economics at Princeton University. I received my A.B. from Harvard University *summa cum laude* and my doctorate from Oxford University. Both degrees are in Economics.

111. I specialize in the economics of industrial organization, which includes the study of antitrust and regulatory policies. I regularly teach courses on microeconomics and business strategy. I am the co-author of a microeconomics textbook, and I have published numerous articles in academic journals and books. I have written academic articles on issues regarding the economics of network industries, systems markets, antitrust enforcement, and telecommunications policy. I am recognized as one of the pioneers in extending the theory of network effects to competitive settings. I am a co-editor of the *Journal of Economics & Management Strategy* and serve on the editorial boards of *Information Economics and Policy* and the *Journal of Industrial Economics*.

112. In addition to my academic experience, I have consulted on the application of economic analysis to issues of antitrust and regulatory policy. I have served as a consultant to both the U.S. Department of Justice and the Federal Communications Commission on issues of antitrust and regulatory policy. I have served as an expert witness before state and federal

courts. I have also provided testimony before state regulatory commissions and the U.S. Congress.

113. From January 1994 through January 1996, I served as the Chief Economist of the Federal Communications Commission under the Clinton Administration. I participated in the formulation and analysis of policies toward all industries under Commission jurisdiction. As Chief Economist, I oversaw both qualitative and quantitative policy analyses.

114. From September 2001 through January 2003, I served as the Deputy Assistant Attorney General for Economic Analysis at the U.S. Department of Justice under the Bush Administration. I directed a staff of approximately fifty economists conducting analyses of economic issues arising in both merger and non-merger enforcement. Our principal professional focus was on understanding and projecting the impacts of various business practices and public policy decisions on consumers' economic welfare. My title as Deputy Assistant Attorney General notwithstanding, I am not an attorney.